



DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
WATER QUALITY MONITORING AND ASSESSMENT SECTION
WATERSHED INFORMATION SHEET

North Fork Salt River Basin-07110005

Basin Description

This portion of the Upper Salt River basin lies in northeastern Missouri. North Fork Salt River originates in Schuyler County near Queen City and flows into Mark Twain Lake. The major tributary streams in this basin are Bear, Black, Crooked and Otter creeks. The downstream end of the basin occurs where these streams flow into Mark Twain Lake. The basin is 893 square miles in area. The largest reservoir in the basin is La Plata New Lake with a surface area of 81 acres. There are four public drinking water reservoirs in this basin.

Average annual rainfall is 39 inches. Stream flow statistics for the basin are shown in Table 1.

Table 1. Stream Flow Statistics for the North Fork Salt River Basin

Stream/Location	Watershed Area (sq.mi.)	Period Of Record	Flow (cfs)				
			90 th Percentile *	Mean	Median **	10 th Percentile ***	7Q10 Low Flow+
North Fk. nr Hagers Grove	365	1974-2004	488	280	30	4.2	
North Fk. nr Shelbina	481	1930-72 1988-2004	656	303	32	2.2	0.0
North Fk. nr Hunnewell	626	1930-88++	1,110	466	58		
Crooked Cr. nr Paris	80	1979-2004	84	62.1	3.1	0.0	

*Flow is less than this amount 90 percent of the time

**Flow is less than this amount 50 percent of the time

***Flow is less than this amount 10 percent of the time

+ The lowest average seven consecutive day flow that occurs with a recurrence interval of 10 years.

++ Record exists for most years in this interval

This portion of the Upper Salt River basin lies within the Dissected Till Plains physiographic province and is characterized by a mixture of hills and open plains. The western uplands of the basin lie within the Central Claypan, an area of very flat lands dominated by row crop agriculture. Basin-wide, 44 percent of the land is row crop, 42 percent is pasture and hay fields, 11 percent forest and 1 percent urban.

Except for areas in the lower portions of the basin where streams have incised Pennsylvanian or Mississippian aged rock, the surface of the basin is glacial till overlain by loess. Glacial till is a mostly unsorted mixture of clay, sand, gravel and rock debris

created and pushed southward into Missouri by the great glacial ice sheets. Loess is a windblown silt deposit. Depth of the till is highly variable but is generally less than 200 feet. Loess deposits are 4-8 feet in depth. The uplands of this basin have soils that contain a claypan layer.

The presence of the claypan in the soils, clayey till and the underlying shale and coal beds ensure that there is very little movement of water to the subsurface. Most water movement in the basin is through the surface stream network. Water that reaches the subsurface will resurface locally when a stream valley incises a confining aquatard (an impermeable layer). Since very little water infiltrates to the subsurface, streamflow can be very high during wet weather. For the same reason, base flows, streamflow sustained only by the re-emergence of groundwater into the stream, are very low during the intervening dry periods. There are no springs of note in the basin.

Water Quality Concerns

Acceptable water quality is defined by Missouri's Water Quality Standards [<http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf>] . Streams or lakes that do not meet these standards are considered "impaired." They may not be fit for certain uses such as swimming, drinking water supply or protection of fish and other aquatic life. Waters are considered "affected" rather than "impaired" if water quality changes are less serious and state standards are not exceeded. These standards also list more than 3,600 classified streams and more than 400 classified lakes in the state. A classified stream is one that is either a permanently flowing stream or one that may stop flowing in dry weather but still maintains large pools of water that support aquatic life. Unclassified streams are the small tributaries to classified streams that typically have flowing water only during wet weather and are dry for the remainder of the year.

Water Quality in Prairie Streams

<http://www.dnr.mo.gov/env/wpp/watersheds/info/wq-prairie-str.pdf>

Aquatic Habitat in Prairie Streams

<http://www.dnr.mo.gov/env/wpp/watersheds/info/aquatic-hab-prairie-str.pdf>

Point Source Pollution

Point source pollution is a discharge of wastewater from a single location such as a wastewater treatment plant. Wastewater treatment plants can serve industries, small businesses, subdivisions, mobile home parks, apartment complexes, or entire cities. Wastewater from residential sources such as subdivisions, apartments and mobile home parks is often referred to as "domestic wastewater" and contains primarily treated human wastes, food wastes and detergents. The primary pollutants of concern in domestic wastewater are the amount of organic matter, which is commonly reported as Biological Oxygen Demand (BOD), suspended solids and ammonia. Industrial and commercial wastewater can be more complex and may contain, in addition to domestic wastes, heavy

metals or man-made organic chemicals that can be potentially toxic. Discharges from most municipal wastewater treatment plants are usually a mixture of domestic and industrial/commercial wastewater. Most wastewater plant discharges are also typically high in nitrogen and phosphorus, two elements that act as fertilizers and can cause excessive algae growth in waters receiving these discharges.

There are 12 permitted domestic or industrial/commercial point sources that discharge a combined 3.04 million gallons per day (mgd) of treated wastewater into the waters of this portion of the Salt River basin. There are 202 miles of classified streams in the basin. Only six miles (3 percent) are known to be affected or impaired by point source wastewater discharges. There are also 4.7 miles of unclassified streams that are affected or impaired by point source wastewater discharges. The only wastewater discharge that affects at least 0.5 miles of its receiving stream is from the Kirksville municipal wastewater treatment plant.

Wastewater Treatment

<http://www.dnr.mo.gov/env/wpp/watersheds/info/wastewater-treatment.pdf>

Nonpoint Source Pollution

Nonpoint source pollution occurs when pollutants are released from numerous points. They are often spread out and difficult to identify and control. In the North Fork Salt River basin, the most serious nonpoint problem is degradation of aquatic habitat. All 202 miles (100 percent) of classified streams in the basin are considered to have degraded aquatic habitat. The lack of infiltration of rainfall, when combined with local soil tillage and other land uses leads to a large amount of surface runoff during wet weather. This contributes to soil erosion and high levels of sediment deposition in streams. The quality of aquatic habitat is further impaired by removal of wooded riparian vegetation, and by the channelization, or straightening, of streams, which has occurred in 53 miles (26 percent) of streams in the basin.

Storm water runoff in the Midwest can carry significant amounts of fertilizers, animal wastes, and pesticides into streams. Atrazine is an agricultural herbicide used on corn and grain sorghum that is commonly found in storm water. Missouri's water quality standards allow no more than 3.0 ug/l Atrazine in drinking water reservoirs as a long-term average. There are three reservoirs in the North Fork Salt River basin that serve as drinking water supplies. Mark Twain Lake to the south of this basin is the supply for Shelbyville. Long term average Atrazine levels in these reservoirs is shown in Table 2. The state standard for the maximum allowable level of Atrazine in a raw public water supply is 3 ug/l as an average. None of the lakes monitored for Atrazine exceed this standard.

Table 2. Long Term Average Atrazine Levels in Reservoirs of the North Fork Salt River Basin and Mark Twain Lake (ug/l).

Reservoir	Average Raw Water Atrazine (ug/l)
Schulyler Co. No. 1 (Queen City)	1.84
Clarence East Reservoir	1.16
La Plata New Reservoir	0.91
Mark Twain Lake	1.49

Finished drinking water is monitored regularly at all public supplies. Finished drinking water in Missouri has been found to meet state standards for pesticides. Levels of Atrazine in finished drinking water supplies may be significantly lower than the amounts found in the reservoirs, if the drinking water plants take measures to reduce Atrazine during the water treatment process.

Drinking water reservoirs throughout northern and western Missouri are also monitored for several other common agricultural herbicides. Results of this monitoring over many years indicates that the only other herbicide that may be a human health concern in drinking water reservoirs is Cyanazine. Cyanazine has not been a problem in any of the drinking water reservoirs in the North Fork Salt River basin. Federal regulations require the end of all Cyanazine use in 2002.

Many private residences use groundwater as a drinking water supply. Studies of private well water quality in northeastern Missouri have shown that about 20 percent of all private wells sampled exceeded drinking water standards for nitrate. And 1-2 percent of wells exceeded drinking water standards or health advisory levels for pesticides, most commonly the herbicides Atrazine or Alachlor. This contamination is often caused by local land use practices or surface contamination of the wellhead and does not represent widespread contamination of the underground aquifer. Deeper aquifers are protected from surface contamination by impermeable strata.

During warm weather, when streams are low, livestock tend to gather in and around streams. The wastes they leave in the water contribute to nuisance algae growths, low levels of dissolved oxygen and elevated levels of ammonia and bacteria.

Water Quality Management

The department achieves water quality management of point source pollutants through the issuance and enforcement of wastewater discharge permits. These permits limit the amount of pollutants that can be discharged. All point source wastewater dischargers must obtain a permit and adhere to its discharge limitations. All permits require at least a level of treatment equal to national wastewater treatment standards. In situations where these national treatment standards are not adequate to protect the streams or lakes receiving these wastewater discharges, stricter permit limits that do protect these waters are required. The permits require regular monitoring and reporting of discharge quality. The department also conducts regular inspection of wastewater treatment facilities and receiving waters.

Nonpoint source pollution is addressed through the state's nonpoint source management plan. This plan is a cooperative program between the Department of Natural Resources and other federal, state and local government agencies or organizations, local landowners and other interested citizens. The plan emphasizes addressing problems at the watershed level through the use of management practices that control nonpoint pollution. The most commonly supported practices are those that control soil erosion on agricultural and urban lands, improve quality and quantity of forage on grazing lands, protect riparian zones, and those that control runoff of animal manure, fertilizers and pesticides. The state nonpoint source management plan is a voluntary program that provides funds to help defray the cost of adopting management practices.

Since 1990, there have been twelve nonpoint source watershed projects in the basin. Four of these have been funded by state sales tax money earmarked for soil and water conservation. Six projects were funded primarily through federal Clean Water Act funds. These projects treated more than 31,800 acres of land, comprising about 5.5 percent of the entire basin. Clean Water Act funds paid for nonpoint source education programs, water quality monitoring and development of watershed management plans.

Table 3. Nonpoint Source Watershed Projects in the North Fork Salt River Basin

Watershed Name	County	Project Date	Watershed Size (Acres)	Acres Treated	Percent of Watershed Treated
Greentop-Queen City lakes	Schuyler	1991-95	2,371	1,062	45%
Clarence	Shelby	1991	4,020	536	13%
Big Bear Cr.	Adair	1994-98	30,232	10,918	36%
Otter Cr	Monroe Shelby	1993-98	67,200	19,299	29%
North Fork Salt R.		1999-2002		NPS Education	
North Fork Salt R.		1999-2000		Wtrshd.Mngt.Plan	
North Fork Salt R.		2000-02		WQ Monitoring	
Mark Twain Lake		1994-97		NPS Education	
Mark Twain Lake		1997-99		NPS Education	
North Fork Salt R.		1993-97		Wtrshd.Mngt.Plan	
North Fork Salt R.	Knox	2003-10			
North Fork Salt R.	Shelby	2003-10			

The Missouri Department of Natural Resources monitors water chemistry and aquatic invertebrate communities at many locations in Missouri. The department also tracks the quality of domestic, industrial and storm water discharges. These monitoring activities provide information on water quality problems, such as their specific location, pollutants, sources and possible solutions. This information guides the management activities the department takes to protect water quality in Missouri.

Web links

US Geological Survey <http://mo.water.usgs.gov/>

Kansas City District Corps of Engineers <http://www.mvs.usace.army.mil/>

Missouri Department of Conservation

<http://www.mdc.mo.gov/fish/watershed/salt/contents/350cotxt.htm>

US Environmental Protection Agency <http://www.epa.gov/region7/water/index.htm>